

pupæ in England, his reason being that he never found they could survive a long exposure to winter temperature. In vol. ix., 1897, pp. 249-51, in a paper "On a collection of Spring Lepidoptera made in the Riviera, etc.," Mr. J. W. Tutt notices, on the authority of Dr. Chapman, the occurrence of *atalanta* in February, and further quotes Chapman as saying that, at Cannes, "during last winter *P. atalanta* was always in evidence, the same individuals at the same places (apparently, and probably really) all the winter, the imagines not emerging or ovipositing, as far as one could judge, but hibernating without hiding away, except on dull and cold days." In this paper Mr. Tutt remarks, "It is well known that the imago of this species never goes into hibernation in the autumn, in Britain, until obliged, feasting first on the hop catkins and later on ivy bloom." In vol. xi., 1899, p. 79, Dr. Chapman remarks that, in February, 1899, in the Riviera, of hibernating butterflies *atalanta* was much the most abundant; and (p. 97) on March 6th he found a full-grown larva. In vol. xii., 1900, p. 53, Mr. J. Mason notes having seen *atalanta* flying about in the bright sun on January 9th, at Clevedon Court, Somersetshire.

(14) Buckler's *Larvæ of British Butterflies and Moths*, vol. i., p. 176, the Rev. John Hellins writes, "I have not many records of this species; perhaps one of the most pleasant entomological memories is that of seeing the butterfly (*atalanta*) in good condition, flying about during a gleam of sunshine on the morning of Christmas Day, 1866; at last it settled on a child's shoulder, and was an object of admiration for some time."

With regard to the question as to whether pairing takes place before or after hibernation, I have seen it stated that females of Vanessids captured in the autumn, and dissected, show no trace of ova, or ova only slightly developed, but I have no personal knowledge of the subject. Boisduval says that impregnation takes place in the spring, but there seems to be a difference of opinion on this point. I once saw a pair of *Pyrameis cardui*, *in cop.*, at Gibraltar, on April 20th.

In very hot and dry localities in the Mediterranean, such as Malta, Gibraltar, etc., where, during the summer months, the foodplant of *atalanta* is practically burnt up, the imagines appear to æstivate, but towards the end of September or beginning of October the weather becomes cooler, the rains commence, and the nettles soon spring up, and then *atalanta* busies itself ovipositing, and, as I have before mentioned, being a long-lived species, larvæ of all sizes, and pupæ, are to be found among the food-plants, and freshly-hatched imagines begin to emerge in November.

At Alexandria, on February 8th, 1898, I found a full-grown larva spun up and preparing to pupate in a bed of nettles, other larvæ of various sizes, and a fresh imago. The larva found on the above date, produced a fine butterfly on the 28th of the same month.

From the above I think it is pretty clear that this species does hibernate in this country.

Larvæ of *Polyommatus icarus* and their connection with ants.

By A. L. RAYWARD, F.E.S.

It is, I think, not very generally known that the larva of our common blue butterfly, *Polyommatus icarus*, like those of at least three other species of our British Lycænids, is possessed of a gland which

secretes a fluid very attractive to ants; in the hope, therefore, that they may be of interest, I give some particulars of an experiment conducted by me a few days ago with two larvæ of *icarus* and a worker ant of the species *Formica flava*, which not only proved the existence in these larvæ of a highly-developed secretory gland, but also showed a high order of instinct, or intelligence, in the ant.

The larvæ experimented with were reared from ova deposited, in confinement, on *Lotus corniculatus*, by a ♀ taken by me at Folkestone in August, 1906; the ova hatched on the 26th and succeeding days of the same month, and the larvæ, after growing satisfactorily for three or four weeks, ceased feeding, and laid up for hybernation about September 21st.

They were wintered on a growing plant of *Lotus corniculatus* in the open, and, during the second week of March of this year, some of the survivors were removed to a warm room and placed upon cut sprigs of *Trifolium repens*; this food they commenced to eat during the following week, and one of them moulted on March 26th. An examination of this freshly moulted larva revealed the fact that it possessed a long, narrow, transverse gland on the dorsum of the 7th abdominal segment, similar to that possessed by the larvæ of our British Lycenids—*arion*, *corydon*, and *bellargus*—and as, in addition, the two conspicuous whitish evaginable tubes on the next following—*i.e.*, the 8th—segment, carried by both *corydon* and *bellargus*, were also present, it appeared probable that *icarus* might, like its allies, have some connection with ants. As soon as opportunity offered, therefore, I put the matter to the test, and was soon satisfied that *icarus* is endowed with a gland which yields a fluid probably similar in character to, and equally attractive to *Formica flava* as, that produced by *arion*, *corydon*, and *bellargus*.

The demonstration was obtained in the following manner:—The larger and more vigorous-looking of the two larvæ employed, was first placed upon the stage of a small dissecting microscope carrying a lens giving a magnification of 16, and an ant was then persuaded to walk upon the stage from a pill-box by means of a camel-hair brush. The ant appeared somewhat sluggish, and at first evinced no interest in the larva, but, after a few moments, walked slowly over its back, and proceeded to clean itself, and particularly its antennæ, very thoroughly. This operation lasted some four or five minutes, and, during its continuance, the larva remained perfectly quiescent, showing no sign whatever of irritation or resentment at the presence of the ant, and careful examination of the gland and evaginable tubes disclosed no sign of movement in these organs, so that I began to fear that the gland might prove, after all, to be a "blind" one, or at least imperfectly developed. Suddenly, however, after having completed a most elaborate "toilet," including the careful cleaning of its antennæ by passing them many times between the prothoracic legs, the ant ran straight to the gland, and, in the most methodical and business-like manner, began to caress it with the antennæ, evidently well aware of the delectable drink waiting to be yielded for the asking, yet the result for several minutes longer continued disappointing, for, although the gland showed some slight sign of contraction, followed by distention, there was no indication of the protrusion of the inner membrane, which always precedes the flow of fluid in *corydon* and *bellargus*.

Still the ant persisted in its coaxings and caresses, and, at length, the evaginable tubes on the 8th segment showed signs of activity, first one, then the other, and presently both together, being evaginated and withdrawn, the time occupied by the double movement of protrusion and retraction being probably less than one second. The ant took little notice of the activity of these tubes, but continued its entreaties at the gland, and, at last, with the desired result, for the greenish inner membrane was slowly protruded, and a bead of viscous-looking fluid was extruded, and was quickly and most eagerly absorbed by the ant. The time occupied by the protrusion of the gland and emission of the fluid, was perhaps three seconds, and about twice that length of time was taken by the ant in drinking the bead of liquid. Four times, in the hour covered by this experiment, did the ant succeed in inducing the larva to yield the fluid, but only after the most persistent and continuous coaxing was success attained, and I do not think the larva yielded voluntarily to the ant's solicitations. The evaginable tubes were most active just before the exclusion of the liquid, and, at the times of their evagination, there was a corresponding pulsation of the lips of the gland; it appeared to me that the action of the tubes was intended to cause the ant to desist from its excitation of the gland, and that, having failed in inducing it to refrain for more than a moment from its labours, the protrusion of the membrane and emission of the fluid were spasmodic and involuntary. The tubes are white, and have, at their apex, a number of filaments or tentacles, but the evagination and retraction were so quickly effected that I was unable to ascertain their number. The second larva subsequently gave a successful demonstration also, and the most interesting feature of the whole experiment appeared to me to be the patient, persistent manner in which the ant continued its caressings, as if it were perfectly well acquainted with the method to be employed, and absolutely assured of the successful issue of its labours. There was at no time any excited running over the body of the larva by the ant, such as was the case in my experiments with *corydon* and *bellargus* last year; it remained for nearly an hour on the posterior half of the larva, and, for several minutes after each successful termination to its entreaties, devoted itself to combing and stroking its antennæ, as though well aware that the larva required time to recover from the treatment to which it had been subjected.

It had been my intention to experiment with these larvæ of *icarus* before hibernation, with the object of ascertaining if any connection existed between this species and ants, but want of leisure prevented my doing so, and I am therefore unable to say whether or not they possess a functional gland in the earlier stages of their life-history. While my observations of the larvæ of *icarus* have, so far, unfortunately been restricted to those reared in confinement, and I cannot, therefore, state positively that they are attended by ants under natural conditions, there can, I think, be very little doubt that they are, occasionally at least, so attended, as the low-feeding habits of the species must certainly frequently bring them into contact with ants, and the functional development of the gland would appear to show that it is not long allowed to remain unemployd.
